JOURNAL OF THE MECHANICS AND PHYSICS OF SOLIDS

EDITORS

L. B. FREUND
Brown University
Division of Engineering

J. R. WILLIS
Cambridge University
Department of Applied Mathematics
and Theoretical Physics

Volume 45 (1997)

Title Section, Volume Contents and Author Index

PERGAMON

AIMS AND SCOPE

Journal of the Mechanics and Physics of Solids. The Journal publishes papers reporting original research on the mechanics of solids. Emphasis is placed on the development of fundamental concepts of mechanics and novel applications of these concepts based on theoretical, experimental or computational approaches, drawing upon the various branches of engineering science and the allied areas within applied mathematics, materials science, structural engineering, applied physics and geophysics. The main purpose of the Journal is to foster scientific understanding of the processes of deformation and mechanical failure of all solid materials, both technological and natural, and the connections between these processes and their underlying physical mechanisms. In this sense, the content of the Journal should reflect the current state of the discipline in analysis, experimental observation and numerical simulation. In the interest of achieving this goal, authors are encouraged to consider the significance of their contributions for the field of mechanics and the implications of their

---

Copyright © 1998 Elsevier Science Ltd. All rights reserved.

Upon acceptance of an article by the journal, the author(s) will be asked to transfer copyright of the article to the publisher. The transfer will ensure the widest possible dissemination of information. This journal and the individual contributions contained in it are protected by the copyright of Elsevier Science Ltd, and the following terms and conditions apply to their use:

Photocopying. Single photocopies of single articles may be made for personal use as allowed by national copyright laws. Permission of the publisher and payment of a fee is required for all other photocopying, including multiple or systematic copying, copying for advertising or promotional purposes, resale, and all forms of document delivery. Special rates are available for educational institutions that wish to make photocopies for non-profit educational classroom use.

In the U.S.A., users may clear permissions and make payment through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, U.S.A. In the U.K., users may clear permissions and make payment through the Copyright Licensing Agency Rapid Clearance Service (CLARCS), 90 Tottenham Court Road, London W1P 9HE, U.K. In other countries where a local copyright clearance centre exists, please contact it for information on required permissions and payments

Derivative works. Subscribers may reproduce tables of contents or prepare lists of articles including abstracts for internal circulation within their institutions. Permission of the publisher is required for resale or distribution outside the institution.

Permission of the publisher is required for all other derivative works, including compilations and translations.

Electronic storage. Permission of the publisher is required to store electronically any material contained in this journal, including any article or part of an article. Contact the publisher at the address indicated.

Except as outlined above, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the publisher.

The Item-Fee Code for this publication is: 0022–5096/98 $19.00+0.00

Disclaimer. No responsibility is assumed by the publisher for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein.

Although all advertising material is expected to conform to ethical (medical) standards, inclusion in this publication does not constitute a guarantee or endorsement of the quality or value of such product or of the claims made of it by its manufacturer.

ContentsDirect delivers the table of contents of this journal, by e-mail, approximately two to four weeks prior to each issue's publication. To subscribe to this free service, complete and return the form at the back of this issue or send an e-mail to cdsubs@elsevier.co.uk, or register online at http://www.elsevier.nl/locate/ContentsDirect.

CONTENTS OF VOLUME 45

Number 1

S. V. HARREN	1	A yield surface and flow rule for orientationally hardening polymers subjected to arbitrary deformations
J. FALESKOG and C. FONG SHIH	21	Micromechanics of coalescence—I. Synergistic effects of elasticity, plastic yielding and multi-size-scale voids
J. J. DITRI	51	Determination of nonuniform stresses in an isotropic elastic half space from measurements of the dispersion of surface waves
K. RANJITH and R. NARASIMHAN	67	Asymptotic fields for dynamic crack growth at a ductile–brittle interface
D. R. S. TALBOT and J. R. WILLIS	87	Bounds of third order for the overall response of nonlinear composites
V. I. FABRIKANT	113	Exact solution of tangential contact problem for a circular domain
G. CHENG and P. PEDERSEN	135	On sufficiency conditions for optimal design based on extremum principles of mechanics
J. F. GANGHOFFER and J. SCHULTZ	151	Interactions between adhesion and friction—I. Theoretical aspects
	175	Announcements
	i	Keywords

Number 2

B. K. AHN and W. A. CURTIN	177	Strain and hysteresis by stochastic matrix cracking in ceramic matrix composites
S. DJ. MESAROVIC	211	The influence of pre-existing dislocations on cleavage crack propagation behavior in crystals
F. M. BORODICH	239	Some fractal models of fracture
N. K. SIMHA	261	Twin and habit plane microstructures due to the tetragonal to monoclinic transformation of zirconia

K. IKEDA, T. CHIDA and E. YANAGISAWA — 293 — Imperfection sensitive strength variation of soil specimens

P. PONTE CASTAÑEDA — 317 — Corrigendum

i — Keywords

Number 3

H. X. ZHU, J. F. KNOTT and N. J. MILLS — 319 — Analysis of the elastic properties of open-cell foams with tetrakaidecahedral cells

J. A. DiLELLIO and W. E. OLMSTEAD — 345 — Temporal evolution of shear band thickness

R. LIPTON — 361 — Variational methods, bounds, and size effects for composites with highly conducting interface

T. CHEN — 385 — Exact moduli and bounds of two-phase composites with coupled multifield linear responses

M. MILGROM — 399 — Some more exact results concerning multifield moduli of two-phase composites

A. C. STEENBRINK, E. VAN DER GIESSEN and P. D. WU — 405 — Void growth in glassy polymers

Y. HUANG, L. ZHANG, T. F. GUO and K.-C. HWANG — 439 — Mixed mode near-tip fields for cracks in materials with strain-gradient effects

467 — Acknowledgement of referees

i — Keywords

Number 4

V. A. LUBARDA — 471 — New estimates of the third-order elastic constants for isotropic aggregates of cubic crystals

H. GAO, T.-Y. ZHANG and P. TONG — 491 — Local and global energy release rates for an electrically yielded crack in a piezoelectric ceramic

J.-S. YU, A. M. MANIATTY and D. B. KNORR — 511 — Model for predicting thermal stresses in thin polycrystalline films

K. RAVI-CHANDAR and B. YANG 535 On the role of microcracks in the dynamic fracture of brittle materials

J. HELSING, G. W. MILTON and A. B. MOVCHAN 565 Duality relations, correspondences and numerical results for planar elastic composites

J. R. WILLIS and A. B. MOVCHAN 591 Three-dimensional dynamic perturbation of a propagating crack

P. C. PRAT and Z. P. BAŽANT 611 Tangential stiffness of elastic materials with systems of growing or closing cracks

i Keywords

Number 5

J. HU and P. H. LEO 637 Defect structures at thin film–substrate interfaces

K. HACKL 667 Generalized standard media and variational principles in classical and finite strain elastoplasticity

L. V. GIBIANSKY and S. TORQUATO 689 On the use of homogenization theory to design optimal piezocomposites for hydrophone applications

W. WANG and Z. SUO 709 Shape change of a pore in a stressed solid via surface diffusion motivated by surface and elastic energy variation

J. FAN and W. S. SLAUGHTER 731 High strain rate compression of fiber composites

J. D. RENTON 753 Pure bending of a solid cone

Z. LIN and V. C. LI 763 Crack bridging in fiber reinforced cementitious composites with slip-hardening interfaces

T. HONEIN and G. HERRMANN 789 Conservation laws in non-homogeneous plane elastostatics

807 This article was withdrawn from production whilst the issue was in print

K. H. KIM and J. J. YIN 841 Evolution of anisotropy under plane stress

D. VANDEMBROUCQ and S. ROUX 853 Mode III stress intensity factor ahead of a rough crack

i Keywords

Number 6

M. GĂRĂJEU and P. SUQUET	873	Effective properties of porous ideally plastic or viscoplastic materials containing rigid particles
A. H. W. NGAN	903	A generalized Peierls–Nabarro model for non-planar screw dislocation cores
V. I. LEVITAS	923	Phase transitions in elastoplastic materials: continuum thermomechanical theory and examples of control—Part I
A. BEKKER and L. C. BRINSON	949	Temperature-induced phase transformation in a shape memory alloy: phase diagram based kinetics approach
L. ZHANG, X. K. ZHU and K. C. HWANG	989	Near-tip field for steady dynamic crack growth in a compressible elastic–plastic material
V. TVERGAARD	1007	Cleavage crack growth resistance due to plastic flow around a near-tip dislocation-free region
D. L. JOHNSON and A. N. NORRIS	1025	Rough elastic spheres in contact: memory effects and the transverse force
O. SIGMUND and S. TORQUATO	1037	Design of materials with extreme thermal expansion using a three-phase topology optimization method
	i	Keywords

Number 7

J. LI and G. J. WENG	1069	A secant-viscosity approach to the time-dependent creep of an elastic–viscoplastic composite
P. DE BUHAN and G. DE FELICE	1085	A homogenization approach to the ultimate strength of brick masonry
J.-Q. TARN	1105	An asymptotic theory for nonlinear analysis of multilayered anisotropic plates
H. M. JENSEN and J. CHRISTOFFERSEN	1121	Kink band formation in fiber reinforced materials
Y. WEI and J. W. HUTCHINSON	1137	Nonlinear delamination mechanics for thin films

C. ARGENTO, A. JAGOTA and W. C. CARTER 1161 Surface formulation for molecular interactions of macroscopic bodies

H. ZHAO and G. GARY 1185 A new method for the separation of waves. Application to the SHPB technique for an unlimited duration of measurement

V. I. LEVITAS 1203 Phase transitions in elastoplastic materials: continuum thermomechanical theory and examples of control. Part II

L. V. GIBIANSKY and S. TORQUATO 1223 Thermal expansion of isotropic multiphase composites and polycrystals

i Keywords

Number 8

Y. WEI and J. W. HUTCHINSON 1253 Steady-state crack growth and work of fracture for solids characterized by strain gradient plasticity

H. F. WEINBERGER 1275 On the nonexistence of certain ideal forming operations for extrusion and drawing dies

T. REITER, G. J. DVORAK and V. TVERGAARD 1281 Micromechanical models for graded composite materials

W. CHEN and G. RAVICHANDRAN 1303 Dynamic compressive failure of a glass ceramic under lateral confinement

P. BISEGNA and R. LUCIANO 1329 On methods for bounding the overall properties of periodic piezoelectric fibrous composites

A. CHISKIS, R. PARNES and L. SLEPYAN 1357 Nonlinear behavior of wavy composites under tension

A. COCHARD and J. R. RICE 1393 A spectral method for numerical elastodynamic fracture analysis without spatial replication of the rupture event

P. C. PRAT and Z. P. BAŽANT 1419 Addendum (with Errata)

i Keywords

Number 9

S. TORQUATO	1421	Effective stiffness tensor of composite media—I. Exact series expansions
A. A. GUSEV	1449	Representative volume element size for elastic composites: a numerical study
F. F. ABRAHAM, D. SCHNEIDER, B. LAND, D. LIFKA, J. SKOVIRA, J. GERNER and M. ROSENKRANTZ	1461	Instability dynamics in three-dimensional fracture: an atomistic simulation
L. XIA, A. F. BOWER, Z. SUO and C. F. SHIH	1473	A finite element analysis of the motion and evolution of voids due to strain and electromigration induced surface diffusion
C. R. PICU and V. GUPTA	1495	Three-dimensional stress singularities at the tip of a grain triple junction line intersecting the free surface
I. SCHMIDT and D. GROSS	1521	The equilibrium shape of an elastically inhomogeneous inclusion
A. MOLINARI	1551	Collective behavior and spacing of adiabatic shear bands
C. SAKAE and L. M. KEER	1577	Application of direct method for a nonlinear-kinematic-hardening material under rolling/sliding line contact: constant ratchetting rate
F. F. ABRAHAM, D. BRODBECK, W. E. RUDGE and X. XU	1595	A molecular dynamics investigation of rapid fracture mechanics
	i	Keywords

Number 10

	iii	Preface
	1619	Chronological list of papers
	1681	Subject index
	1707	Author index

Number 11/12

F. BARLAT, Y. MAEDA, K. CHUNG, M. YANAGAWA, J. C. BREM, Y. HAYASHIDA, D. J. LEGE, K. MATSUI, S. J. MURTHA, S. HATTORI, R. C. BECKER and S. MAKOSEY	1727	Yield function development for aluminum alloy sheets
M. P. BENDSØE and R. LIPTON	1765	Extremal overall elastic response polycrystalline materials
M. MILLER and P. DAWSON	1781	Influence of slip system hardening assumptions on modeling stress dependence of work hardening
A. LION	1805	On the large deformation behaviour of reinforced rubber at different temperatures
R. V. KUKTA and L. B. FREUND	1835	Minimum energy configuration of epitaxial material clusters on a lattice-mismatched substrate
L. E. SHILKROT and D. J. SROLOVITZ	1861	Anisotropic elastic analysis and simulation of adatom–adatom interactions on solid surfaces
H. X. ZHU, N. J. MILLS and J. F. KNOTT	1875	Analysis of the high strain compression of open-cell foams
Z. K. LU and G. J. WENG	1905	Martensitic transformation and stress relations of shape-memory alloys
K. IKEDA, K. MUROTA, Y. YAMAKAWA and E. YANAGISAWA	1929	Mode switching and recursive bifurcation in granular materials
D. J. BENSON, V. F. NESTERENKO, F. JONSDITTIR and M. A. MEYERS	1955	Quasistatic and dynamic regimes of granular material deformation under impulse loading
A. S. SANGANI and G. MO	2001	Elastic interactions in particulate composites with perfect as well as imperfect interfaces
L. WU and X. MARKENSCOFF	2033	Asymptotics for thin elastic ligaments with applications to body force and thermal loading
P. ROSAKIS and J. K. KNOWLES	2055	Unstable kinetic relations and the dynamics of solid–solid phase transitions
	I	Keywords

AUTHOR INDEX

Abraham, F. F. 1461, 1595
Ahn, B. K. 177
Argento, C. 1161

Barlat, F. 1727
Bažant, Z. P. 611,1419
Becker, R. C. 1727
Bekker, A. 949
Bendsøe, M. P. 1765
Bisegna, P. 1329
Borodich, F. M. 239
Bower, A. F. 1473
Brem, J. C. 1727
Brinson, L. C. 949
Brodbeck, D. 1595

Carter, W. C. 1161
Chen, T. 385
Chen,W. 1303
Cheng, G. 135
Chida, T. 293
Chiskis, A. 1357
Christoffersen, J. 1121
Chung, K. 1727
Cochard, A. 1393
Curtin, W. A. 177

De Buhan, P. 1085
De Felice, G. 1085
DiLellio, J. A. 345
Dawson, P. 1781
Ditri, J. J. 51
Dvorak, G. J. 1281

Fabrikant, V. I. 113
Faleskog, J. 21
Fan, J. 731
Fong Shih, C. 21
Freund, L. B. 1835

Ganghoffer, J. F. 151
Gao, H. 491
Gărăjeu, M. 873
Gary, G. 1185
Gerner, J. 1461
Gibiansky, L. V. 689,1223
Gross, D. 1521
Guo,T. F. 439
Gupta, V. 1495
Gusev, A. A. 1449

Hackl, K. 667
Harren, S. V. 1
Hattori, S. 1727
Hayashida, Y. 1727
Helsing, J. 565
Herrmann, G. 789
Honein, T. 789
Hu, J. 637
Huang, Y. 439
Hutchinson, J. W. 1137,1253
Hwang, K.-C. 439,989

Ikeda, K. 293

Jagota, A. 1161
Jensen, H. M. 1121
Johnson, D. L. 1025

Keer, L. M. 1577
Kim, K. H. 841
Knorr, D. B. 511
Knott, J. F. 319, 1875
Kukta, R. V. 1835

Land, B. 1461
Lege, D. J. 1727
Leo, P. H. 637
Levitas, V. I. 923, 1203
Li, J. 1069
Li, V. C. 763
Lifka, D. 1461
Lin, Z. 763
Lion, A. 1805
Lipton, R. 361, 1765
Lu, Z. K. 1905
Lubarda, V. A. 471
Luciano, R. 1329

Maeda, Y. 1727
Makosey, S. 1727
Maniatty, A. M. 511
Matsui, K. 1727
Mesarovic, S. DJ. 211
Miller, M. 1781
Milgrom, M. 399
Mills, N. J. 319, 1875
Milton, G. W. 565
Molinari, A. 1551
Movchan, A. B. 565, 591
Murtha, S. J. 1727

Narasimhan, R. 67
Ngan, A. H. W. 903
Norris, A. N. 1025

Olmstead, W. E. 345

Parnes, R. 1357
Pedersen, P. 135
Picu, C. R. 1495
Ponte Castañeda, P. 317
Prat, P. C. 611, 1419

Ranjith, K. 67
Ravi-Chandar, K. 535
Ravichandran, G. 1303
Reiter, T. 1281
Renton, J. D. 753
Rice, J. R. 1393
Rosenkrantz, M. 1461
Roux, S. 853
Rudge, W. E. 1595

Sakae, C. 1577
Schmidt, I. 1521
Schneider, D. 1461
Schultz, J. 151
Shih, C. F. 1473
Shilkrot, L. E. 1861
Sigmund, O. 1037
Simha, N. K. 261
Skovira, J. 1461
Slaughter, W. S. 731
Slepyan, L. 1357
Srolovitz, D. J. 1875
Steenbrink, A. C. 405
Suo, Z. 709, 1473
Suquet, P. 873

Talbot, D. R. S. 87
Tar, J.-Q. 1105
Tong, P. 491
Torquato, S. 689, 1037, 1223, 1421
Tvergaard, V. 1007, 1281

Van der Giessen, E. 405
Vandembroucq, D. 853

Wang, W. 709
Wei, Y. 1137, 1253
Weinberger, H. F. 1275
Weng, G. J. 1069, 1905
Willis, J. R. 87, 591
Wu, P. D. 405

Xia, L. 1473
Xu, X. 1595

Yanagawa, M. 1727
Yanagisawa, E. 293
Yang, B. 535
Yin, J. J. 841
Yu, J.-S. 511

Zhang, L. 439, 989
Zhang, T.-Y. 491
Zhao, H. 1185
Zhu, X. 319,1875
Zhu, X. K. 989

AVAILABLE AT YOUR FINGERTIPS...

THE ELSEVIER SCIENCE CATALOGUE ON THE INTERNET

Features include:

ELSEVIER SCIENCE

Catalogue on INTERNET

- ORDER YOUR **FREE** SAMPLE COPY OF *JOURNAL/BOOK TITLE* TODAY BY CHECKING ITS CATALOGUE ENTRY

Other features include:-

- All the journals, with complete information about journal editors and editorial boards
- Listings of special issues and volumes
- Listings of recently published papers for many journals
- Complete descriptions and contents lists of book titles
- Clippings of independent reviews of published books
- Book series, dictionaries, reference works
- Electronic and CD-ROM products
- Full text search facilities
- Ordering facilities
- Print options
- Hypertext links
- Alerting facility for new & forthcoming publications
- Updated monthly

TRY IT TODAY!

http://www.elsevier.nl/

For further queries please contact:-

Customer Support Department
Tel: +1 (212) 633 3730
Fax: +1 (212) 633 3680
E-mail: usinfo-f@elsevier.com

Customer Support Department
Tel: +31 (20) 485 3757
Fax: +31 (20) 485 3432
E-mail: nlinfo-f@elsevier.nl

ELSEVIER SCIENCE

Catalogue on INTERNET

CO7A05/p15

ELSEVIER | PERGAMON | NORTH HOLLAND | EXCERPTA MEDICA

Receive Regular News of Elsevier 's Publications

Elsevier Science mails information on new and existing publications regularly.
If you would like to be added to the mailing list please send us your name and full mailing address, indicating your fields of interest:

ENGINEERING
Energy Sources & Technology, Civil & Structural Engineering, Mechanical Engineering, Electrical & Electronic Engineering, Systems & Control Engineering, Aeronautical & Aerospace Technology, Materials Technology, Chemical Engineering

LIFE SCIENCES & MEDICINE
Biological Sciences (including biochemistry & molecular biology), Agriculture, Immunology, Cancer Research, Pharmacology, Neuroscience, Vision Science, Clinical Medicine

PHYSICAL SCIENCES
Computer Science, Physics, Chemistry, Mathematics, Earth Science, Environmental Science, Materials Science, Space & Planetary Sciences

SOCIAL SCIENCE & HUMANITIES
Sociology, Women's Studies, Psychology, Education, Political Science, Geography, Economics, Management & Business, Linguistics, Information Science, Librarianship, Safety, Transportation

Elsevier Science
Regional Sales Office, Customer Support Department, PO Box 211, 1000 AE Amsterdam, The Netherlands
• Telephone: +31 20-4853757 • Fax: +31 20-4853432
• E-mail: nlinfo-f@elsevier.nl

Elsevier Science
Regional Sales Office, Customer Support Department, 655 Ave of the Americas, New York, NY 10010, USA
• Telephone: +1-212-633-3730 • Fax: +1-212-633-3680
• E-mail: usinfo-f@elsevier.com

CO7A05/p6

Did you know that if you are a contributor to any Elsevier Science Book or Journal you are entitled to

30%

Discount on all

our Books*?

Elsevier Pergamon North Holland Excerpta Medica

*(except multi-volume reference works)

Contact your nearest Elsevier Science office in order to obtain a subject catalogue

Elsevier Science, Regional Sales Office, Customer Support Department,
PO Box 211, 1000 AE Amsterdam, The Netherlands
• Telephone: +31 20-4853757 • Fax: +31 20-4853432 • E-mail: nlinfo-f@elsevier.nl

Elsevier Science, Regional Sales Office, Customer Support Department,
655 Ave of the Americas, New York, NY 10010, USA
• Telephone: +1-212-633-3730 • Fax: +1-212-633-3680 • E-mail: usinfo-f@elsevier.com

C07A05/p11

JOURNAL OF THE MECHANICS AND PHYSICS OF SOLIDS

NOTES FOR AUTHORS

I. AIMS AND SCOPE

The Journal publishes papers reporting original research on the mechanics of solids. Emphasis is placed on the development of fundamental concepts of mechanics and novel applications of these concepts based on theoretical, experimental or computational approaches, drawing upon the various branches of engineering science and the allied areas within applied mathematics, materials science, structural engineering, applied physics and geophysics. The main purpose of the Journal is to foster scientific understanding of the processes of deformation and mechanical failure of all solid materials, both technological and natural, and the connections between these processes and their underlying physical mechanisms. In this sense, the content of the Journal should reflect the current state of the discipline in analysis, experimental observation and numerical simulation. In the interest of achieving this goal, authors are encouraged to consider the significance of their contributions for the field of mechanics and the implications of their results, in addition to describing the details of their work.

II. SUBMISSION DETAILS

1. Papers should be submitted to one of the Editors. Submission addresses are: Professor L. B. Freund, Division of Engineering, Brown University, Providence, RI 02912, U.S.A. and Professor J. R. Willis, Department of Applied Mathematics and Theoretical Physics, Cambridge University, Silver Street, Cambridge CB3 9EW, U.K. They will be judged from the standpoint of scientific originality, significance and literary style. The preparation of review articles may be invited by the Editors but it is requested that no uninvited contributions of that kind be submitted. The Journal appears 12 issues per annum, 12 issues making up one volume.

2. Only papers that have not previously been published can be accepted and authors must agree not to publish elsewhere the papers submitted to and accepted by the Journal. All authors must sign the 'Transfer of Copyright' agreement before the article can be published. This transfer agreement enables Elsevier Science Ltd to protect the copyrighted material for the authors, but does not relinquish the author's proprietary rights. The copyright transfer covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of similar nature and translations, and includes the right to adapt the article for use in conjunction with computer systems and programs, including reproduction or publication in machine-readable form and incorporation in retrieval systems. Authors are responsible for obtaining from the copyright holder permission to reproduce any figures for which copyright exists. Requests to reproduce any paper either wholly or in part should be addressed to the publishers.

3. Corresponding authors will receive 25 free offprints of their paper, and a reprint order form will also be sent with the proofs.

III. AUTHOR SERVICE DEPARTMENT

For queries relating to the general submission of articles (including electronic text and artwork) and the status of accepted manuscripts, please contact the Author Service Department: e-mail: authors@elsevier.co.uk; fax: (+44) (0) 1865 843905; tel.: (+44) (0) 1865 843900.

IV. MANUSCRIPT REQUIREMENTS

1. Authors must submit *three* copies (one to be a top copy) of all manuscripts and all ancillary material.

2. Manuscripts should be prepared with a typewriter or laser printer, on one side of the paper only, double spaced with ample margins. The text must be ready for printing and should be carefully checked for errors. Authors will receive proofs for correction.

3. Illustrations should be restricted to the minimum necessary. They *must* be of sufficient quality to permit direct reproduction. Original diagrams and photographs will be required, either at the time of submission or upon acceptance. Figure captions should be listed on a separate sheet. Tables should also be submitted in sufficiently clear form to allow direct reproduction. Authors should choose five keywords from the list published at the back of each issue of the Journal.

4. References to published literature should be quoted in the text by the author followed by the year. Thus, "... as demonstrated by Smith (1989) ..." or "... following previous work (Smith, 1989; Jones, 1990) ...". References should be listed in alphabetical order at the end of the paper. Abbreviations should be arranged in the style of the 4th edition of the *World List of Scientific Periodicals*, with the exception that adjectives should start with a capital letter. Titles of articles should be included. For example:

Johnson, K. L. (1987) *Contact Mechanics*. Cambridge University Press, Cambridge.

Qin, Q. and Bassani, J. L. (1992) Non-Schmid yield behavior in single crystals. *J. Mech. Phys. Solids* **40**, 813–833.

Rice, J. R. (1968) A path-independent integral and the approximate analysis of strain concentration by notches and cracks. *J. Appl. Mech.* **35**, 379–386.

Spencer, A. J. M. (1982) Deformation of ideal granular materials. In *Mechanics of Solids: The Rodney Hill 60th Anniversary Volume*, ed. H. G. Hopkins and M. J. Sewell, pp. 607–652. Pergamon Press, Oxford.

5. The corresponding author's name and full postal address should be indicated on the manuscript. Page proofs will be sent to the corresponding author for final proofreading. The text should be concise and in a readily understandable style. The technical description of the methods used should only be given in detail when such methods are new. The essential contents of the paper should be briefly recapitulated in a summary on the title page.

6. For papers produced using a word-processor or LaTeX, please submit a disk with the **final revised version** of the manuscript. The file on disk should correspond exactly to the hard copy. The operating system and the word-processor used should be specified clearly. Illustrations or chemical structures in electronic format may be supplied provided that the file format and the program used to produce them is clearly indicated and that a hard copy is also supplied. More detailed guidelines and further information are available from the publisher.

7. Corrections to the proofs should be restricted to the printer's errors only. Any other substantial changes at this stage may be charged to the author.

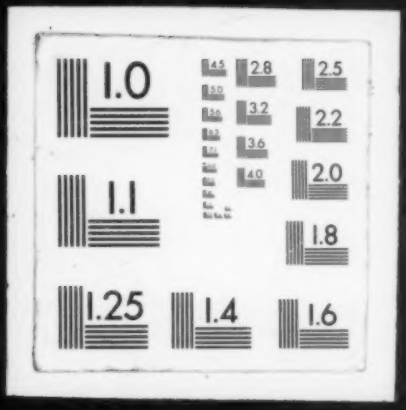
8. It would be appreciated if authors would notify the publishers of any change of address which occurs whilst their papers are in the process of publication.

9. The manuscript and diagrams will be discarded one month after publication unless the publishers are requested to return original material to the author.

ELSEVIER SCIENCE LIMITED

The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K.

Printed in Great Britain by BPC-AUP Aberdeen Ltd


1.0
1.1
1.25
1.4
1.6
2.8
2.5
3.2
2.2
3.6
2.0
4.0
1.8